temperature. These observations confirmed the rectilinear relation with the first three; but in the case of the two alcohols, evidence was obtained of molecular association, as also with acetic acid. It is possible to calculate the amount of association at any temperature in such cases. For, assuming the constancy of κ for the molecular surface of the "normal" liquids, the equation

$$\kappa/d = x^{\frac{2}{3}},$$

where d is the differential coefficient of an associating liquid, and x is the molecular aggregation, gives the number of simple molecules which have united to form a compound at the temperature chosen. For the alcohols at $-90°$, and for acetic acid at $20°$, the association of molecules approximates to $(C_2H_4O_2)_4$, $(CH_4O)_4$, and $(C_2H_6O)_4$,

We have thus a method by which it is possible to ascertain the molecular complexity of undiluted liquids. The results with the alcohols are shown to agree within reasonable limits with those obtained from strong solutions by Raoult's method.

It is incidentally shown in the course of the paper that there is no angle of contact between liquid and glass, when the liquid surface is in contact only with its own vapour. Ordinary measurements of capillarity give inconstant, and probably inaccurate, results, for it is not the surface tension of the liquid which is measured, but that of a solution of air in the surface film of the liquid.

The paper contains tables and curves exemplifying and illustrating the statements given.

IV. "The Absolute Thermal Conductivities of Copper and Iron." By R. Wallace Stewart, B.Sc. (Lond.), Assistant Lecturer and Demonstrator in Physics, University College, Bangor. Communicated by Lord Kelvin, P.R.S. Received March 2, 1893.

(Abstract.)

The experiments described in the paper were undertaken with the object of determining the theoretical conductivity at different temperatures of iron, and, in particular, of pure electrolytically deposited copper.

The method adopted was that due to Forbes, with two modifications.

(*a*.) The thermo-electric method of determining temperature was employed. The thermo-electric couple used was one of German silver and iron, giving, between 0° C. and 200° C., a uniform deflection on the galvanometer scale of about four divisions for a difference of one degree centigrade between the temperatures of its junctions.

(*b*.) The bar was protected from currents of air and external radiation by surrounding it by a trough of sheet zinc.

The range of temperature over which the observations extended was from 15° C. to about 220° C.

The iron bar used was a square $\frac{3}{4}$-inch bar of ordinary wrought iron; the copper bar was a round $\frac{1}{2}$-inch bar of pure electrolytic copper. The reduction of the data of experiment was effected by the aid of curves drawn to a scale sufficiently large to secure the necessary accuracy.

In the case of the copper bar two distinct determinations, I and II, were made under different conditions, and the observations reduced separately. The results of these two determinations agreed within rather less than $1\frac{1}{2}$ per cent.

In order to reduce diffusivity to absolute conductivity, the densities of the iron and copper were determined hydrostatically, and the variation of the specific heat of iron with the temperature was determined by Bunsen's calorimeter with the result that the specific heat at $t°$ C. was found to be given by—$s_t = 0{\cdot}1095(1+0{\cdot}00008\,t)$. For the specific heat of copper the result given by Bède ($s_t = 0{\cdot}0892+0{\cdot}000065\,t$) was taken.

The final results obtained are indicated by the formulæ given below, and tend to show that for both copper and iron the conductivity decreases with rise of temperature.

Results for Iron in C.G.S. Units.

Diffusivity, κ, at $t°$ C. is given by—

$$\kappa_t = 0{\cdot}208\,(1-0{\cdot}00175\,t),$$

and the absolute thermal conductivity, k, by—

$$k_t = 0{\cdot}172\,(1-0{\cdot}0011\,t).$$

Results for Copper in C.G.S. Units.

Diffusivity, κ, at $t°$ C. is given by—

$$\text{I.}\quad \kappa_t = 1{\cdot}370\,(1-0{\cdot}00125\,t).$$
$$\text{II.}\quad \kappa_t = 1{\cdot}391\,(1-0{\cdot}00120\,t).$$

The mean of these results is taken as—

$$\kappa_t = 1{\cdot}38\,(1-0{\cdot}0012\,t),$$

and the value of the absolute conductivity, k, is then given by—

$$k_t = 1{\cdot}10\,(1-0{\cdot}00053\,t).$$

As the experimental observations supply data for the calculation of the emissive power of the surfaces of the bars at different temperatures, a table is given at the end of the paper showing the emissive power of the surface of each bar at temperatures between 20° C. and 200° C. The values obtained agree fairly with those given by Macfarlane and Tait for somewhat similar surfaces.

V. "Preliminary Notice on the Arrow-Poison of the Wa Nyika and other Tribes of East Equatorial Africa, with special reference to the Chemical Properties and Pharmacological Action of the Wood from which it is prepared." By THOMAS R. FRASER, M.D., F.R.S., Professor of Materia Medica in the University of Edinburgh, and JOSEPH TILLIE, M.D. (Edin.). Received March 6, 1893.

Burton,* Cameron,† and other travellers have given accounts of much interest of an arrow-poison used in warfare and in the chase by the Wa Nyika, Wa Kamba, Wa Gyriama, and other tribes of Eastern Equatorial Africa. The poison was stated to be prepared from the wood of the stem and root of a tree, which, however, was not botanically identified.

Several years ago, an opportunity was given to one of us to examine poisoned arrows, and the poison used in smearing them, of the Wa Nyika tribe. While the pharmacological action of this poison was found to have a close resemblance to that of *Strophanthus* seeds, its physical and chemical properties enabled the conclusions to be drawn that the poison was not made from these seeds, but was chiefly composed of an extract prepared from a wood.‡

These conclusions have been confirmed by the examination of further specimens of the Wa Nyika arrow-poison, and of the wood from which it is prepared. The specimens were most kindly sent to one of us, at various times between 1889 and 1892, by the Rev. William Morris, of the Church Missionary Society's East African Mission, and by Mr. Berkeley, the Administrator to the Imperial British East Africa Company at Mombasa.

These gentlemen have also sent the leaves and fruit of the plant, which have enabled us to identify it as an *Acokanthera;* but, as flowers have not yet been obtained, it has not been possible to determine the species.

* 'The Lake Regions of Central Africa,' 1860, vol. 2, p. 305.

† 'Across Africa,' 1885, p. 59.

‡ Fraser, "On *Strophanthus hispidus:* its Natural History, Chemistry, and Pharmacology," 'Edinburgh Roy. Soc. Trans.,' vol. 35, Part IV, 1890, pp. 966–67.